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A DESCRIPTION OF THE MALE OF PERIPATUS EISENII WHEELER.¹

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THIS new *Peripatus* from Tepic, Mexico, was named by Dr. W. M. Wheeler, of the University of Texas, and the female was described by him in the *Journal of Morphology* for October, 1898. It is from his material, which Dr. Wheeler has placed in my hands, and under his guidance, that I have obtained the following results. In this paper I have undertaken to give a description of the general external character of the male as differing from the female, and a description of its reproductive organs, with a brief account of the spermatophores. I hope in a short time to follow this up with the anatomical details, and later on to give the embryology of this most interesting animal.

The males proved to be so abundant in the material that an excellent opportunity presented itself for the study of this sex. Out of the original number, consisting of eighty-six specimens, thirty-two, on close examination, were found to be males. They are very much smaller than the mature females; in fact, several of the mature males in the material were smaller than embryo females (2 cm. in length) which I removed from the uterus. The largest of the males measured only 2.8 cm., while the largest female was 5.8 cm. in length. As to whether the sexes differ in color I cannot say, since a glycerine preparation used in softening the animals for sectioning has removed much of the color.

It has already been shown that this species varies in the number of its walking appendages, as do all the other well-known neotropical forms. The highest number of legs for *Peripatus Eisenii* is twenty-nine pairs, while the lowest is

¹ *Contributions from the Zoölogical Laboratory of the University of Texas*, No. 5. Director W. M. Wheeler.

twenty-four pairs.¹ Sedgwick's statement that the males have the lowest number of legs holds good here in every case except one. All those specimens having twenty-nine, twenty-eight, or twenty-seven pairs of legs were females, while all those with twenty-six, twenty-five (with one exception), or twenty-four pairs were males.

The number of these appendages is fixed at birth, as is also the case with *P. Edwardsii*, as Sedgwick has shown, and the

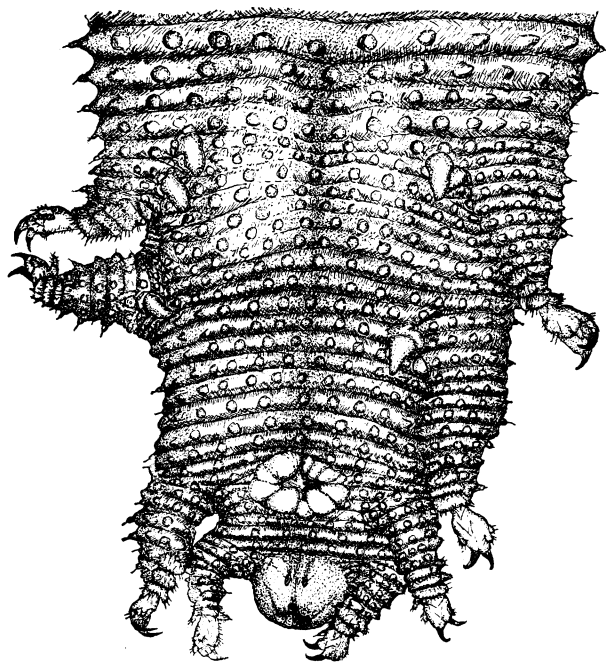


FIG. 1.

number of appendages of the mother is not necessarily transmitted to the embryo. From a mother with twenty-seven pairs of legs, three embryos were removed, each with twenty-eight pairs of appendages; and again from a mother with twenty-eight pairs of legs three embryos were removed, the two most mature of which had twenty-five pairs, while the less mature one had twenty-six pairs. These last three specimens had

¹ Dr. Wheeler mentioned in his paper one specimen with twenty-three pairs of appendages; this I was unable to find after carefully reexamining all the males.

other external characters, apart from the number of appendages, in the appearance of the posterior portion of the body, which, embryos as they were, showed them to be males.

The anterior legs of the males are like those of the females, each possessing four pads and a pedal groove. The nephridial opening is on the second pad from the base, on the fourth and fifth

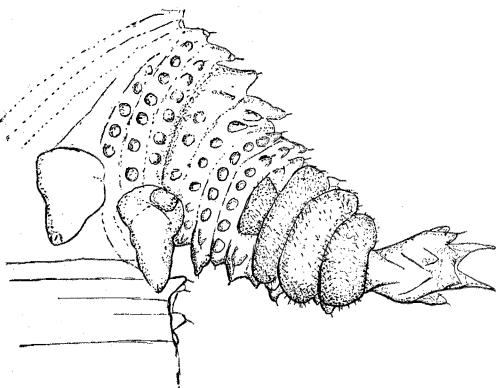


FIG. 2.

leg, as in the female. On the third posterior leg the proximal pad becomes much reduced and entirely disappears on the penultimate leg, while on the last leg only the two distal pads remain, with a portion of the original second proximal pad.

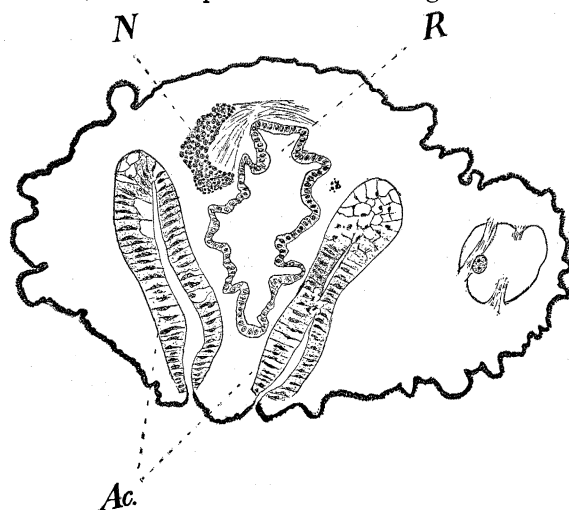


FIG. 3.

On the four posterior pairs of appendages there are no pedal grooves, and here begins the difference between the appendages of the two sexes. In the place of the pedal grooves, which are entirely wanting on the third and fourth posterior

legs, there are two long, soft papillae for each appendage. This is invariably the sign of the male *Peripatus Eisenii*, and these papillae, with an opening at the tip for the outlet of the *crural*

glands, are always on the third or fourth posterior appendages. The only specimen with twenty-five pairs of legs, which did not have these tubercles, was opened and found to be a female. The position of these papillae can best be seen from Fig. 2, which is a camera lucida drawing of the left fourth leg. Fig. 1 is a drawing of the ventral surface of the posterior end of an animal 2.4 cm. in length. At first sight the fourth or third leg may appear to have only one papilla or none at all, but on closer examination the tip of the papilla will be seen to be surrounded by a circular ridge. Sections through these posterior legs of different individuals show that the tubercles are of uniform development in all males, and that they can be retracted or protruded in the living animal. The section also shows that the papillae are retracted only by involuntary muscle fibers inserted on these papillae. Fig. 4 represents a section through the fourth leg. The inner papilla is protruded, while the outer

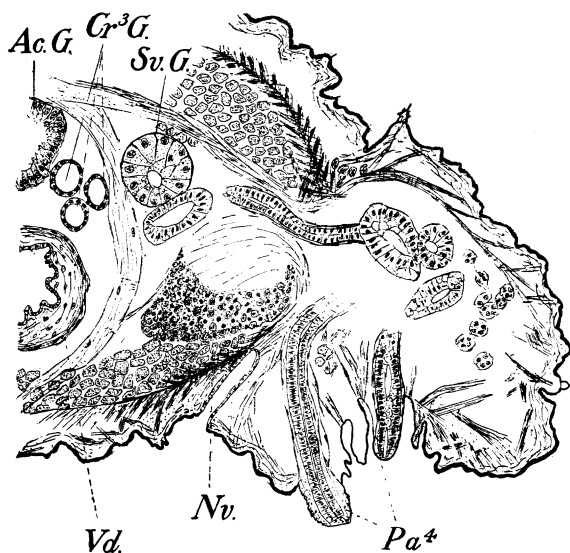


FIG. 4.

one is partially withdrawn. Fig. 5 is a section through the third leg, showing the inner tubercle more retracted than the outer one in Fig. 4. This tubercle has about reached its limit of retraction. The outer papilla was cut to one side, so as to

show the cup-shaped depression in which it rests and the distinct outline of the epidermis which makes it look like a diminutive pine cone.

The opening of the generative organs is, like that in the female, between the penultimate pair of legs; but this pair of

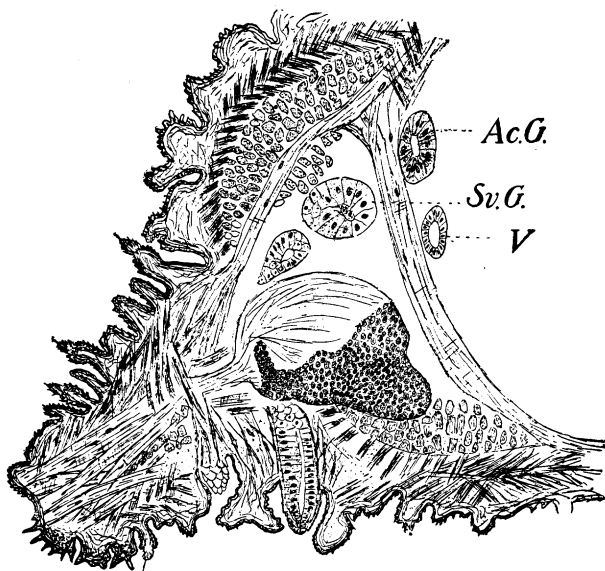


FIG. 5.

appendages, unlike that of the female, has no trace of a pedal groove, and the same may be said of the last pair. There is likewise no trace of the nephridium in the penultimate pair of legs, whereas the last pair possesses these organs, which appear in section with small external openings.

Just as there are crural glands in the male, which are wanting in the female, so also are there *accessory glands*. There is a pair of these glands which opens externally by two small slits situated between the generative and anal openings, about a fourth of the distance from the latter. Fig. 3 represents a camera drawing of a section through the orifices of these accessory cells.

Before leaving the consideration of the exterior of *P. Eisenii* it is well to speak of a thing of interest which relates to both the sexes, and which has not been mentioned before in connec-

tion with this species. It is a bean-shaped papilla that is always found in a depression on the dorsal surface of the leg

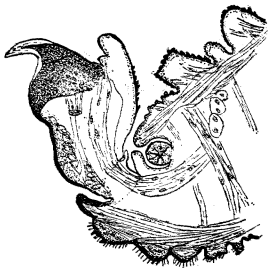


FIG. 6.

where it joins the foot. Gaffron describes this papilla in *P. Edwardsii*. Sedgwick says it is also found in the Trinidad species and is probably characteristic of all the neotropical forms. The surface of the depression in which the papilla lies is smooth, while the papilla itself shows a distinct cell structure, the cells all converging

toward the center. Fig. 6 represents a longitudinal section through the foot splitting the papilla.¹

From the number of external outlets of glands connected with the generative tract, it is readily seen that the male repro-

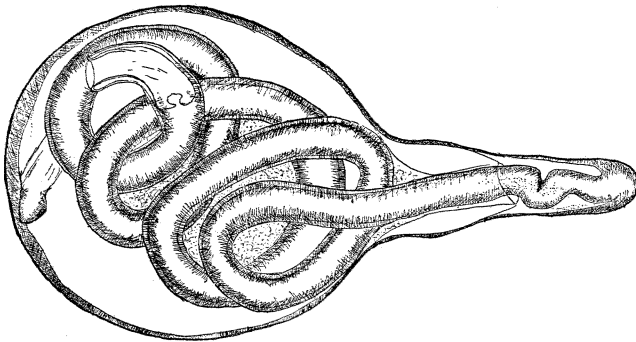


FIG. 7 a.

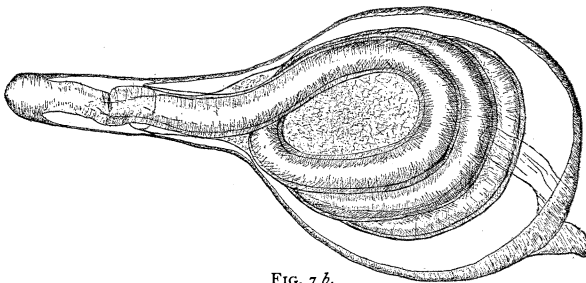


FIG. 7 b.

¹ It seems from the position of these papillae, especially when the foot is drawn in, that they are sensory. If this be true, the comparison of the foot of *Peripatus Eisenii* with the parapodium of the Chaetopoda is rather striking, the sensory papillae corresponding to the cirri.

ductive organs are much more complicated than those of the female. The latter has two fused ovaries, paired receptacula ovarum, paired receptacula semines, and paired uteri. The testes are large tubular organs beginning at about the posterior third of the body and running backward without much twisting to the seminal vesicles, which are somewhat larger in diameter. The seminal vesicles appear as dilatations of the testes, the right one of which is some distance in front of the left. The vesicles of all the specimens I have examined are full of the spermatogonia discharged from the testes, spermatocytes, and spermatozoa. The material was collected in October, when the testes were active. The seminal vesicles lead posteriorly into a

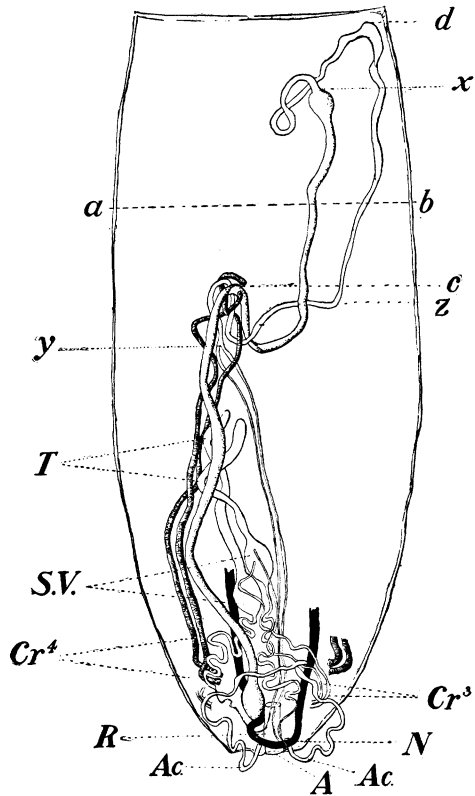


FIG. 8.

pair of exceedingly convoluted vasa deferentia, the right one of which passes over and then under the nerve to join the left, which passes under the nerve. They then run forward side by side, as two small, very thin-walled, straight ducts, for some distance, till they unite to form a common duct. These paired portions of the vasa deferentia are quite full of spermatozoa. The unpaired portion of the testicular ducts is of great length, sometimes exceeding twice the length of the whole body. This tube is clearly divided into two portions, the first

two-thirds of which are comparatively thin walled and lined with ciliated cells, while the last third has a non-ciliated epithelial lining and very thick muscular wall. This thick-walled portion terminates in an enlarged sack which might well be called the spermatophore sack, since it holds a spermatophore in nearly all the specimens examined. The sack opens on the exterior by means of the generative orifice between the penultimate pair of legs.

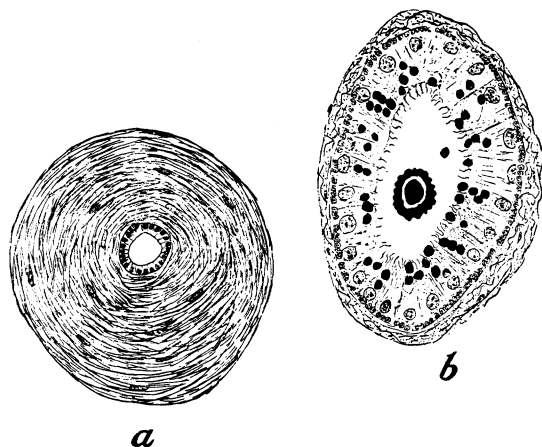


FIG. 9.

The portion of the vas deferens possessing the thick muscular wall does not constitute the spermatophore maker, as Moseley found in *P. N. Zealandiae*, but it is the thin-walled portion which has this

function, though the epithelium is ciliated in that region.

Fig. 8 is a partially diagrammatic drawing of the male reproductive organs of *Peripatus Eisenii*. The vas deferens from *c* to its termination has a thick muscular wall. From *y* to *d* and thence back to *c* the wall is comparatively thin, and the lining cells are at the same time ciliated and secretory. Especially active are the cells of that portion which begins at about *z* and ends at *d*. Here the most substantial portion of the spermatophore is made. In secretion great balls of a glutinous substance staining dark in haematoxylin are formed in the inner cells and given off. They become packed into the spermatophore rod in the most regular manner, making its surface appear to be marked off in regular hexagons, not indicated in my drawing. This rod receives lighter secretions as it passes along, carrying before it a packet of spermatozoa around which it becomes very much coiled in the dilated distal portion

of the vas deferens, or spermatophore sack. Here the coiled spermatophore seems to receive other layers of secretions which form a case of some thickness. Fig. 7 and 7 a are camera drawings of two views of a spermatophore, the pointed end of which projects forward in the vas deferens.

The crural glands which open out through the above-described papillae are found only in the male. These glands from the fourth pair of legs are large and extend almost half the length of the animal. They leave the lateral compartment of the body (unlike the same glands of *P. capensis*, which run their whole distance in this portion of the body) almost immediately to coil around the vas deferens. The crural glands of the third pair of legs are very thin tubes winding in and around the convoluted portions of the vasa deferentia, and around the seminal vesicles, where they end. The accessory glands are large tubes which are situated dorsally to the other organs; they run posteriorly (the right one going over and just under the nerve), to empty a very short distance in front of the anus.

In concluding this description, one point of great interest presents itself which cannot be overlooked. *This is the rapid sexual development of the males to maturity.* I observed that in sections of very small specimens which could not have been long from the uterus, the seminal vesicles were distended with ripe and rapidly developing spermatozoa. In a male embryo which was removed and sectioned, I found in the seminal vesicle not a few spermatozoa and spermatids in abundance. It would seem to follow from these conditions that the males of the neotropical species of *Peripatus* must be rather short-lived, and this fact will probably account for their scarcity.

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